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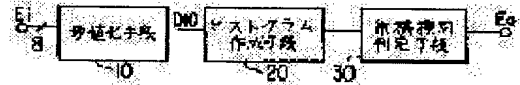
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(54) PICTURE PROCESSOR

(57)Abstract:

PURPOSE: To easily identify the type of a processing object picture in the unit of picture by counting the number of picture elements for each density of a picture signal subjected to multi-value processing so as to generate a density histogram and using the histogram information so as to discriminate the type of the processing object picture.

CONSTITUTION: An input signal E_i is, e.g. a monochromatic picture signal having a gray scale of 8-bit/256 gradation or a color picture signal of 24-bit/16,000,000 colors. The gray scale of the signal E_i corresponds to the density of the original picture. The signal E_i is compared with plural kinds of threshold levels at a histogram generator 20, in which the signal is converted into a multi-value processing signal D10. The generator 20 generates the density histogram of the original picture based on the signal D10. A shape formed by each frequency of the generated density histogram differs from a character or a picture. An original type discrimination device 30 discriminates a type of the original and provides an output of an original type discrimination signal E_o based on the difference from the tendency as '0' for the character and as '1' for the picture.



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CLAIMS

[Claim(s)]

[Claim 1] The image processing system characterized by providing a multiple-value-ized means to multiple-value-ize the picture signal of the attention pixel in a processing-object image, a histogram creation means to accumulate the number of pixels for every concentration of the multiple-value-ized picture signal, and to create a gray level histogram, and a judgment means to judge the classification of said processing-object image with said created pattern of a gray level histogram.

[Claim 2] The image processing system according to claim 1 with which said judgment means is characterized by judging the classification of said processing-object image based on the size of the sum of the frequency of the low concentration section of said gray-level-histogram information, and the high concentration section.

[Claim 3] The image processing system according to claim 1 with which said judgment means is characterized by judging the classification of said processing-object image based on the number of the peaks of said gray-level-histogram information.

[Claim 4] The image processing system according to claim 1 with which said judgment means is characterized by judging the classification of said processing-object image based on the predetermined number of concentration which has the above frequency comparatively to the maximum peak frequency in said gray-level-histogram information.

[Claim 5] The image processing system according to claim 1 with which said judgment means is characterized by judging the classification of said processing-object image based on the size of the frequency of the halftone section of said gray-level-histogram information.

[Claim 6] The image processing system according to claim 1 with which said judgment means is characterized by judging the classification of said processing-object image based on the breadth of distribution of the peak part of said gray-level-histogram information.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention makes a processing object two or more document images containing an alphabetic character manuscript or a photograph manuscript, and what is processed is related with the image processing system which distinguishes an alphabetic character manuscript or a photograph manuscript.

[0002]

[Description of the Prior Art] Generally, to the manuscript read with reading means, such as a scanner, in the document image processor which can treat not only code (alphabetic character) information but image (photograph) information, the image information with the contrast of an alphabetic character, a diagram, etc. performs simple binary-ization with a fixed threshold, and the image information which has gradation, such as a photograph, is performing binary-ization with false gradation-ized means, such as an error diffusion method.

[0003] Although definition is secured and image quality degradation is not produced in an alphabetic character and a line drawing field when simple-binary-ization-processing the read image information with a fixed threshold, in a photograph drawing image domain, neither gradation nature nor color reproduction nature (in the case of a color) is secured, but image quality degradation arises. Although gradation nature is secured and image quality degradation is not produced in a photograph drawing image domain in the case where the read image information is gradation-ization-processed by an error diffusion method etc. on the other hand, in an alphabetic character and a line drawing field, resolution falls and image quality deteriorates.

[0004] That is, it cannot be satisfied with simple binary-ized processing of image quality of each alphabetic character / photograph field where the descriptions differ to the read image information at coincidence. Therefore, in order to be satisfied with coincidence of the image quality of each alphabetic character / photograph field where the descriptions differ, the need of judging the classification (are they an alphabetic character or a photograph?) of a processing-object image, and performing the optimal processing for the image comes out.

[0005] There are some which were proposed as an approach of separating two fields of an alphabetic character/photograph, in reference "the binary-ized art (Institute of Electronics, Information and Communication Engineers paper magazine' 84/7 Vol.J67-B No. 7) of the manuscript with which a binary-ized image and a shade image are intermingled" as "a field separation method classified by block (Block Adaptive Thresholding Method:BAT law)" about the above-mentioned problem. By the approach of the above-mentioned reference, block division of the object image is carried out, and the concentration change within a block performs field separation. that time -- (**) -- a binary image (an alphabetic character/diagram) -- a concentration gradient -- large -- (**) -- the property of concentration change that a shade image (photograph) has a small concentration gradient is used. Hereafter, the procedure is explained briefly.

a) Divide an object image into the block of a mxn pixel first.

[0006] b) Ask a degree for the signal Dmax of the maximum concentration, and the signal Dmin of the minimum concentration on the image concentration level within a block, and compute the maximum concentration difference signal dDmax within a block from both difference.

c) Separate a photograph field and an alphabetic character field by comparing threshold Th and $dDmax$ which were set up beforehand, considering as an alphabetic character field, if it is $dDmax \geq Th$, and considering as a photograph field, if it is $dDmax < Th$. However, when all the inside of a block is a white pixel or a black pixel, it is defined as being an alphabetic character field.

An alphabetic character / photograph field can be separated and the above-mentioned procedure enables it to perform suitable binary-ized processing to each field.

[0007]

[Problem(s) to be Solved by the Invention] The field separation method classified by block mentioned above carries out the discernment judging of the processing-object image about the classification (are they an alphabetic character or a photograph?) per a block unit or pixel. By this approach, even if an object image is an alphabetic character image, when thin alphabetic characters and color alphabetic characters, such as handwriting, are intermingled there, said maximum concentration difference signal $dDmax$ becomes comparatively small, and the block judged in the same image to be an "alphabetic character" and the block judged to be a "photograph" will be intermingled. Then, it will become a bad homogeneous image. In order to avoid this problem, it is necessary to carry out the discernment judging of the processing-object image per a block unit or pixel, but to carry out a discernment judging per image.

[0008] The purpose of this invention is offering the image processing system which can carry out the discernment judging of the classification (are their alphabetic character or a photograph?) of a processing-object image per image. It is offering the image processing system which can carry out the discernment judging of the classification of a processing-object image per image with the configuration (pattern) of the gray level histogram of the whole image especially.

[0009]

[Means for Solving the Problem] The image processing system of this invention possesses a means to multiple-value-ize the picture signal of the attention pixel in a processing-object image, a means to accumulate the number of pixels for every concentration of the multiple-value-ized picture signal, and to create a gray level histogram, and a judgment means to judge the classification of a processing-object image from the configuration of this histogram using the information on a gray level histogram.

[0010]

[Function] In this equipment said judgment means in the size of the sum of the frequency of the low concentration section of (1) gray-level-histogram information, and the high concentration section (2) As opposed to the maximum peak frequency in the number and (3) gray-level-histogram information of a peak on gray-level-histogram information in the predetermined number of concentration which has the above frequency comparatively (4) The size of the frequency of the halftone section of gray-level-histogram information and the breadth of distribution of the peak section of (5) gray-level-histogram information is caught as a description of a histogram configuration, and the classification of a processing-object image is judged.

[0011]

[Example] Drawing 1 shows the configuration of the image processing system concerning one example of this invention. The input picture signal Ei which incorporated and obtained the manuscript of an alphabetic character or a photograph with the scanner etc. is inputted into the multiple-value-ized means 10. Signal Ei is a monochrome picture signal with the gray scale of for example, 8 bits / 256 gradation, or is a color picture signal (8 bits of three primary colors of each are processed) of 24 bits / 16 million color. The gray scale of Signal Ei support the concentration of the manuscript image of a basis.

[0012] The input picture signal Ei is compared with two or more sorts of thresholds in the histogram creation means 20, and is changed into the multiple-value-ized signal $D10$. The histogram creation means 20 creates the gray level histogram of a manuscript image from this multiple-value-ized signal $D10$.

[0013] The number of the gray level histograms created is decided according to the number of multiple-value-izing by the multiple-value-ized means 10. For example, when the number of multiple-value-izing by the multiple-value-ized means 10 is n pieces, the number of histograms also becomes n pieces.

[0014] The form (pattern) which each frequency (frequency) of the created gray level histogram makes shows an inclination which is different the case of an alphabetic character manuscript, and in the case of a photograph manuscript. The manuscript classification judging means 30 judges the classification of a manuscript by the approach of mentioning later based on the difference in this inclination, outputs the manuscript classification judging signal Eo, and can constitute it from a microcomputer (or CPU). If the judgment signal Eo is for example, an alphabetic character manuscript, it serves as logic "0" level, and if it is a photograph manuscript, it serves as logic "1" level.

[0015] In addition, since this judgment algorithm is easy, not only the software by CPU but hardware logic can realize the configuration which acquires the judgment signal Eo. That is, limitation is carried out for the manuscript classification judging means 30 to neither a microcomputer nor CPU. Drawing 2 shows the example of the multiple-value-ized means 10 shown in drawing 1, and the histogram creation means 20.

[0016] When the number of multiple-value-izing is set to n, the multiple-value-ized means 10 consists of encoders 103 which code the comparison result C of n memory 101 which stored the thresholds Th1-Thn of n pieces, n comparators 102 which compare the input picture signal Ei for n threshold Th1 - Thn(s) of each, and comparators 102 (g). Here, thresholds Th1-Thn are $Th1 < Th2 < Th3 \dots$ It shall have the magnitude of $< Thn$.

[0017] When signal level of the input picture signal (manuscript concentration) Ei is set to f and the comparison result of signal level f, and threshold Th1 - Thn(s) with each is set to C (g), C (g=0)-C (g=n-1) are as follows. : C(zero to n-1) = "0" : $f < Th1$ C (0) = "1" ; C(one to n-1) = "0" : $Th2 > f \geq Th1$ C(0 1) = "1" ; C(two to n-1) = "0" : $Th3 > f \geq Th2$ C(0-2) = "1" ; C(three to n-1) = "0" : $Th4 > f \geq Th3 \dots$ C(zero to n-2) = "1" ; C(n-1) = "0" : $Thn > f \geq Thn-1$ C(zero to n-1) = "1" : $f \geq Thn$

[0018] :g=0 which outputs the multiple-value-ized signal D10 which an encoder 103 codes Above C (g=0)-C (g=n-1), and has n steps of following values (g=0-g=n-1) : $f < Th1$ g=1 : $Th2 > f \geq Th1$ g=2 : $Th3 > f \geq Th2$ g=3 : $Th4 > f \geq Th3 \dots$ g=n-2: $Thn-1 > f \geq Thn-2$ g=n-1 : $f \geq Thn-1$ - here, as for the magnitude of a value g, g=0 is the minimum value and g=n-1 is maximum.

[0019] That is, if signal level f of an input picture signal (manuscript concentration) is $f < Th1$, the multiple-value-ized signal D10 will take the minimum value of g=0, if it is $f \geq Thn-1$, the multiple-value-ized signal D10 will take the maximum of g=n-1, and if it is $Th3 > f \geq Th2$, the multiple-value-ized signal D10 will take the mean value of g=2. This encoder 103 can consist of programmable logic devices.

[0020] The multiple-value-ized signal D10 with the n steps of above-mentioned values is inputted into the decoder 201 of the histogram creation means 20. A decoder 201 has the output D of n pieces (0) - D (n-1), and only the output according to the value of the inputted signal D10 makes it logic level "1." the output D of these n pieces (0) - D (n-1) - n adders 202 - each - on the other hand, it is given to an input. The output of n registers 203 is given to the another side input of these adders 202, respectively, and the addition result of an adder 202 is returned to the register 203 which corresponds, respectively. All of the contents of these registers 203 are cleared whenever Signal Ei is given. This decoder 201 can also consist of programmable logic devices.

[0021] in addition, the time of the input picture signal Ei reading the manuscript of A3 size in the resolution of 400dpi - n registers 203 - respectively - being alike - the capacity of 25 bits is needed.

[0022] The adder 202 and the register 203 constitute the accumulation circuit (rise counter) prepared for n sorts of each level of the multiple-value-ized signal D10. For example, when a signal D10 takes the mean value of g=2, the decoder output D (2) serves as "1" level, and the other outputs D (0-1) and D (three to n-1) serve as "0" level altogether. In this case, "1" is added to the contents (the number of frequency) of the register (2) by the adder (2), and output [of a register (2)] H (2) increases by one (rise count). Similarly, when the decoder output D (0) is "1", 1 rise count of the register output H (0) is carried out, when the decoder output D (1) is "1", 1 rise count of the register output H (1) is carried out, and when the decoder output D (n-1) is "1", 1 rise count of the register output H (n-1) is carried out.

[0023] The above-mentioned rise count (accumulation processing) is repeated by the multiple-value-ized means 10 for every pixel value by which a sequential input is carried out, and it is

continued until the input for the page 1 of a manuscript is completed. Register output H (0) obtained after this input is completed shows the accumulation frequency of the low concentration section of an input manuscript, the register output H (n-1) shows the accumulation frequency of the high concentration section of an input manuscript, and register output H (1) – H (n-2) come to show the accumulation frequency of the middle concentration section (halftone field) of an input manuscript. And what arranged register output H (0) – H (n-1) in order of concentration serves as a gray level histogram of the multiple-value-ized picture signal.

[0024] In this way, graph-izing differs the obtained gray level histogram from its configuration/pattern with the alphabetic character manuscript and the photograph manuscript. Then, it can judge whether it is what depends on a photograph manuscript whether it is what the inputted picture signal depends on an alphabetic character manuscript by detecting the difference between this configuration/pattern by the approach described below.

[0025] Hereafter, n= 8 explains the example of the manuscript classification judging approach supposing the easy case where an input image is multiple-value-ized. (A histogram consists of eight concentration accumulation frequency H (0) – H (7) in this case.)

(The 1st judgment approach)

[0026] Drawing 3 shows the typical gray level histogram obtained from an alphabetic character and a photograph manuscript. With reference to this drawing, how to judge whether it is an alphabetic character image in the size relation of the sum of the frequency of the low concentration section and the frequency of the high concentration section or it is a photograph is explained below.

[0027] An alphabetic character manuscript consists of the alphabetic character sections indicated a background and there, and, generally a background occupies most. There is almost no image which has the gradation between the concentration level of a background and the concentration level of the alphabetic character section with an alphabetic character manuscript. Considering the alphabetic character manuscript with which the black alphabetic character (high concentration) was now indicated by the white (low concentration) background, frequency concentrates on the low concentration section and then frequency concentrates on the high concentration section. Then, the gray level histogram of an alphabetic character manuscript becomes the configuration where the center section was dented so that it may illustrate to drawing 3 (a).

[0028] On the other hand, speaking generally, much image information's concentrating on a middle gradation part, although a photograph manuscript has all the gradation (gray scale) from the low concentration section to the high concentration section. If considering the photograph manuscript with which the image (middle concentration) accompanied by gray scale joined the white (low concentration) background now the rate of this middle concentration image area occupied in a manuscript is comparatively large, frequency will concentrate on the middle concentration section. Then, the configuration (pattern) of the gray level histogram of a photograph manuscript becomes that from which the center section projected so that it may illustrate to drawing 3 (b).

[0029] When its attention is paid to the least concentration section (H (0) side) and the maximum-density section (H (7) side) of a gray level histogram here, it turns out that the sums of frequency [of the least concentration section] H (0) and frequency [of the maximum-density section] H (7) differ clearly with an alphabetic character manuscript and a photograph manuscript. : $H(0)+H(7) \geq Tx1$; $Eo="0$ [then,] which comes to be able to carry out the discernment judging of an alphabetic character manuscript and the photograph manuscript if the predetermined comparison level Tx1 is set up and the following comparisons are performed --

" (alphabetic character manuscript) --
 $H(0)+H(7) < Tx1$; $Eo="1$ " (photograph manuscript)

(The 2nd judgment approach) Next, with reference to drawing 4 , how to judge whether it is an alphabetic character image or it is a photograph with the number of the peaks (maximal value) of the frequency where it appears in a histogram is explained.

[0030] Since concentration concentrates on two places, a background and the alphabetic character section, with an alphabetic character manuscript, as shown in drawing 4 (a), the peak

of accumulation frequency is made to two places, the least concentration section and the maximum-density section. On the other hand, since it is the image in which a subject has gray scale with a photograph manuscript, as shown in drawing 4 (b), the probability as for which the peak of concentration is made to one place of a halftone field is high. the above-mentioned peak in a gray level histogram -- $H(i) \geq H(i-1)$ and $H(i) \geq H(i+1)$ -- if histogram $H(i)$ which fulfills conditions is searched, it can discover. in addition, the parameter i -- $0 \leq i < n$ (this example $i = 0-7$) -- conditions shall be fulfilled

[0031] In the example of drawing 4 (a), a peak is discovered by two places, $H(i=0)$ and $H(i=7)$, and a peak is discovered in the example of drawing 4 (b) at one place of $H(i=4)$. Then, when the number of the discovered peaks (the number of i) is set to P , it comes to be able to carry out the discernment judging of an alphabetic character manuscript and the photograph manuscript from the following relation : $P \geq 2; E_o = "0"$ (alphabetic character manuscript)

$P \geq 2; E_o = "1"$ (photograph manuscript)

(The 3rd judgment approach)

[0032] Next, when the number of the maximum frequency which appears in a histogram is made into 100% with reference to drawing 5 , how to judge whether it is an alphabetic character image or it is a photograph with the number of concentration with the frequency more than $T\%$ ($0 < T < 100$) is explained.

[0033] Generally, with a photograph manuscript, big frequency is distributed widely relatively [part / halftone], and big frequency is narrowly distributed over low-concentration and high-concentration both ends with an alphabetic character manuscript with it. Since image area usually becomes large relatively rather than the alphabetic character section with an alphabetic character manuscript in the background, the value (peak quantity) of frequency of the probability for the direction of a low concentration side to become high is higher than a high concentration side. Then, the predetermined frequency level T more than the frequency by the side of high concentration is set up below by the frequency by the side of low concentration, and the thing of the frequency more than level T is observed. Then, with an alphabetic character manuscript, frequency is relatively low, and frequency becomes large relatively with a photograph manuscript. Drawing 5 (a) and (b) have illustrated how what has frequency higher than $T = 50\%$ is different with an alphabetic character manuscript and a photograph manuscript. Then, when the parameter i which makes $H(\max)$ the maximum frequency value and becomes $0 \leq i < n$ is considered, it is $H(i) \geq H(\max) \times T(\%)$.

$M < T \times 2; E_o = "0"$ which comes to be able to carry out the discernment judging of an alphabetic character manuscript and the photograph manuscript from the following relation if the number of ***** i is set to M and two predetermined comparisons T_x are set up -- " (alphabetic character manuscript) --

$M \geq T \times 2; E_o = "1"$ (photograph manuscript)

(The 4th judgment approach) Next, with reference to drawing 6 , how to judge whether it is an alphabetic character image or it is a photograph due to the size frequency in the halftone section of a histogram is explained.

[0034] Since the background with low concentration occupied most with the alphabetic character manuscript and the high-concentration alphabetic character section is contained in it, high frequency concentrates on the low concentration section and the high concentration section. On the other hand, with a photograph manuscript, in order that an image with gray scale may occupy most, what has comparatively high frequency gathers for the middle concentration section. Therefore, if its attention is paid to a halftone part, as shown in drawing 6 (a), with an alphabetic character manuscript, frequency will be low, and frequency will increase with a photograph manuscript.

[0035] $H(n/2-1) + H(n/2) < T \times 3; E_o = "0"$ [then,] which comes to be able to carry out the discernment judging of an alphabetic character manuscript and the photograph manuscript from the following relation if some are chosen for the frequency of a halftone part (for example, $H(3)$ and $H(4)$) and three predetermined comparisons T_x are set up ($n = 8$) -- " (alphabetic character manuscript) --

$H(n/2-1) + H(n/2) \geq T \times 3; E_o = "1"$ (photograph manuscript)

(The 5th judgment approach) Next, with reference to drawing 7 , how to judge whether it is an

alphabetic character image or it is a photograph according to distribution (breadth) of the peak which appears in a histogram is explained.

[0036] Since the background with low concentration occupied most with the alphabetic character manuscript and the high-concentration alphabetic character section is contained in it as already stated, high frequency concentrates on the narrow range of the low concentration section and the high concentration section. On the other hand, with a photograph manuscript, in order that an image with gray scale may occupy most, what has comparatively high frequency is widely distributed over the middle concentration section.

[0037] Then, the predetermined level L is set to the peak frequency value of a histogram, for example, 30% of place. From the location (drawing 7 (a) $H(0)$; drawing 7 (b) $H(4)$) of a peak frequency value If the spacing W to the location (drawing 7 (a) $H(2)$; drawing 7 (b) $H(1)$) of the frequency value nearest to [in the inside below level L] a peak location is detected and four predetermined comparisons T_x are set up : $W < T_x 4$; $E_o = "0"$ which comes to be able to carry out the discernment judging of an alphabetic character manuscript and the photograph manuscript from the following relation (alphabetic character manuscript)

$W \geq T_x 4$; $E_o = "1"$ (photograph manuscript)

[0038] in addition, a group with the frequency value exceeding level L , if width-of-face W' of the biggest thing (drawing 7 (a) $H(0)$, $H(1)$; drawing 7 (b) $H(2)$ - $H(6)$) is detected inside and predetermined number T_x of comparisons⁴ is set up : $W' < T_x 4$; $E_o = "0"$ to which the discernment judging with an alphabetic character manuscript and a photograph manuscript is attained even if it uses the following relation (alphabetic character manuscript)

$W' \geq T_x 4$; $E_o = "1"$ (photograph manuscript)

(The 6th judgment approach)

[0039] Next, with reference to drawing 8 , how to judge whether it is an alphabetic character image or it is a photograph due to the size ratio of the area which the frequency in the histogram halftone section makes, and the area which the complement makes is explained.

[0040] Now, the maximum frequency obtained from a black poor manuscript or a white poor manuscript is set to Z , and the same histogram as drawing 6 is written in in the field S formed by the width of face of frequency $H(0) - H(7)$, and the maximum frequency Z . If a halftone part is perceived among this histogram, as shown in drawing 8 (a) and (b), the ratios $S1/S2$ of the area $S1$ which frequency [of a histogram] $H(3)$ and $H(4)$ make, and the remaining area $S2$ (S one's complement about the view aspect product of Z flat surface) of the view section differ with an alphabetic character manuscript and a photograph manuscript. : $S1/S2 < T_x 5$; $E_o = "0"$ [then,] which comes to be able to carry out the discernment judging of an alphabetic character manuscript and the photograph manuscript from the following relation if five predetermined comparisons T_x are set up -- " (alphabetic character manuscript) --

$S1/S2 \geq T_x 5$; $E_o = "1"$ (photograph manuscript)

[0041] In addition, although the judgment of manuscript classification is possible for this invention at any one of two or more of the above-mentioned approaches, in the case where a photograph manuscript with little halftone information with strong contrast is treated like a brush alphabetic character manuscript like an alphabetic character manuscript with comparatively much halftone information, and a graphic form photograph, distinction can become difficult. In this case, three or more may be used together among the above-mentioned approaches, and manuscript classification may be judged from that result. For example, if the 1st and 3rd approach judges a certain photograph manuscript with a photograph manuscript even if the 2nd approach judges with an alphabetic character manuscript, it can be judged to be a photograph manuscript.

[0042]

[Effect of the Invention] According to this invention, the classification of an object image can be easily judged from histogram information. Moreover, in this invention, since the classification judging of an image is not carried out per a block unit or pixel like before, but a classification judging is performed per image and single processing will be performed to the whole image, a homogeneous good image processing becomes possible.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing 1 is the block diagram showing the configuration of the image processing system concerning one example of this invention.

[Drawing 2] Drawing 2 is the block diagram showing the example of the multiple-value-ized means shown in drawing 1, and a histogram creation means.

[Drawing 3] Drawing 3 is drawing explaining how to illustrate the gray level histogram obtained from an alphabetic character and a photograph manuscript, and to judge whether it is an alphabetic character image in the size relation of the sum of the frequency of the low concentration section, and the frequency of the high concentration section, or it is a photograph.

[Drawing 4] Drawing 4 is drawing explaining how to judge whether it is an alphabetic character image or it is a photograph with the number of the peaks (maximal value) which illustrate the gray level histogram obtained from an alphabetic character and a photograph manuscript, and appear in a histogram.

[Drawing 5] Drawing 5 is drawing explaining how to judge whether it is an alphabetic character image or it is a photograph with the number of the concentration which has the frequency more than T % ($0 < T < 100$) when the number of the maximum frequency which illustrates the gray level histogram obtained from an alphabetic character and a photograph manuscript, and appears in a histogram is made into 100%.

[Drawing 6] Drawing 6 is drawing explaining how to illustrate the gray level histogram obtained from an alphabetic character and a photograph manuscript, and to judge whether it is an alphabetic character image or it is a photograph due to the size frequency in the halftone section of a histogram.

[Drawing 7] Drawing 7 is drawing explaining how to judge whether it is an alphabetic character image or it is a photograph according to distribution (breadth) of the peak which illustrates the gray level histogram obtained from an alphabetic character and a photograph manuscript, and appears in a histogram.

[Drawing 8] Drawing 8 is drawing explaining how to judge whether it is an alphabetic character image or it is a photograph due to the size ratio of the area which illustrates the gray level histogram obtained from an alphabetic character and a photograph manuscript, and the frequency in the histogram halftone section makes, and the area which the complement makes.

[Description of Notations]

10 [... Threshold memory, 102 / ... A comparator, 103 / ... An encoder, 201 / ... A decoder, 202 / ... An adder, 203 / ... A register, E_i $E_i(f)$ / ... An input picture signal, $C(g)$ / ... A comparison result, E_o / ... Manuscript classification judging signal.] ... A multiple-value-ized means, 20 ... A histogram creation means, 30 ... A manuscript classification judging means, 101

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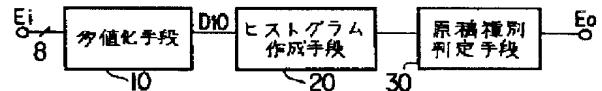
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(54)【発明の名称】 画像処理装置

(57)【要約】

【目的】処理対象画像の種別(文字か写真か)を画像単位で識別判定する。

【構成】処理対象画像における注目画素の画像信号を多値化し、多値化した画像信号の濃度毎に画素数をカウントして濃度ヒストグラムを作成し、作成した濃度ヒストグラムの情報を用いてこのヒストグラムの形状から処理対象画像の種別を判定する。



【特許請求の範囲】

【請求項1】 処理対象画像における注目画素の画像信号を多値化する多値化手段と、
多値化した画像信号の濃度毎に画素数を累算し濃度ヒストグラムを作成するヒストグラム作成手段と、
前記作成された濃度ヒストグラムのパターンによって前記処理対象画像の種別を判定する判定手段とを具備したことを特徴とする画像処理装置。

【請求項2】 前記判定手段が、前記濃度ヒストグラム情報の低濃度部と高濃度部の頻度の和の大小に基づき前記処理対象画像の種別を判定することを特徴とする請求項1に記載の画像処理装置。

【請求項3】 前記判定手段が、前記濃度ヒストグラム情報のピークの数に基づき前記処理対象画像の種別を判定することを特徴とする請求項1に記載の画像処理装置。

【請求項4】 前記判定手段が、前記濃度ヒストグラム情報における最大ピーク頻度に対して所定の割合以上の頻度を持つ濃度数に基づき前記処理対象画像の種別を判定することを特徴とする請求項1に記載の画像処理装置。

【請求項5】 前記判定手段が、前記濃度ヒストグラム情報の中間調部の頻度の大小に基づき前記処理対象画像の種別を判定することを特徴とする請求項1に記載の画像処理装置。

【請求項6】 前記判定手段が、前記濃度ヒストグラム情報のピーク部分の分布の広がりに基づき前記処理対象画像の種別を判定することを特徴とする請求項1に記載の画像処理装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 この発明は、文字原稿や写真原稿を含む複数の文書画像を処理対象とし、処理するものが文字原稿か写真原稿かを判別する画像処理装置に関する。

【0002】

【従来の技術】 一般に、コード（文字）情報だけでなく画像（写真）情報も扱える文書画面処理装置においては、スキャナなどの読取手段で読み取った原稿に対して、文字や線図等のコントラストのある画像情報は固定しきい値にて単純2値化を行ない、写真などの階調を有する画像情報は誤差拡散法などの疑似階調化手段によって2値化を行なっている。

【0003】 読み取った画像情報を固定しきい値で単純2値化処理する場合、文字および線画領域では解像性が確保され画質劣化は生じないが、写真画像領域では階調性や色再現性（カラーの場合）が確保されず画質劣化が生じる。一方、読み取った画像情報を誤差拡散法などにより階調化処理する場合では、写真画像領域では階調性が確保され画質劣化は生じないが、文字および線画領域

では解像度が低下して画質が劣化する。

【0004】 すなわち、単純な2値化処理では、読み取った画像情報に対して、特徴の異なる文字／写真領域それぞれの画質を同時に満足することはできない。したがって、特徴の異なる文字／写真領域それぞれの画質を同時に満足するためには、処理対象画像の種別（文字か写真か）を判定しその画像に最適な処理を施す必要がでてくる。

【0005】 上記問題に関し、文字／写真の2領域を分離する方法として、文献「2値化画像と濃淡画像の混在する原稿の2値化処理方法（電子情報通信学会論文誌'84/7 Vol. J67-B No. 7）」において「ブロック別領域分離法（Block Adaptive Thresholding Method: BAT法）」として提案されたものがある。上記文献の方法では、対象画像をブロック分割し、ブロック内の濃度変化により領域分離を行なう。その際、（イ）2値画像（文字／線図）は濃度勾配が大きく、（ロ）濃淡画像（写真）は濃度勾配が小さいといった濃度変化の性質を利用する。以下、その手順を簡単に説明する。

a) まず、対象画像を $m \times n$ 画素のブロックに分割する。

【0006】 b) 次にブロック内の画像濃度レベルで最大濃度の信号 D_{max} と最小濃度の信号 D_{min} を求め、両者の差からブロック内の最大濃度差信号 $d_{D_{max}}$ を算出する。

c) 予め設定したしきい値 Th と $d_{D_{max}}$ とを比較し、 $d_{D_{max}} \geq Th$ なら文字領域とし、 $d_{D_{max}} < Th$ なら写真領域とすることで、写真領域と文字領域を分離する。ただし、ブロック内がすべて白画素または黒画素の場合は文字領域であると定義する。

上記処理手順により、文字／写真領域を分離でき、各領域に対し適切な2値化処理を施すことが可能となる。

【0007】

【発明が解決しようとする課題】 上述したブロック別領域分離法は、処理対象画像をブロック単位あるいは画素単位でその種別（文字か写真か）について識別判定するものである。この方法では、対象画像が文字画像であっても、そこに手書き等の薄い文字や色文字が混在していると、前記最大濃度差信号 $d_{D_{max}}$ が比較的小さくなり、同一画像中で「文字」と判定されるブロックと「写真」と判定されるブロックとが混在することになる。すると均一性の悪い画像となってしまう。この問題を回避するには、処理対象画像をブロック単位あるいは画素単位で識別判定するのではなく、画像単位で識別判定する必要がある。

【0008】 この発明の目的は、処理対象画像の種別（文字か写真か）を画像単位で識別判定することができ画像処理装置を提供することである。とくに、画像全体の濃度ヒストグラムの形状（パターン）により処理対

象画像の種別を画像単位で識別判定することができる画像処理装置を提供することである。

【0009】

【課題を解決するための手段】この発明の画像処理装置は、処理対象画像における注目画素の画像信号を多値化する手段と、多値化した画像信号の濃度毎に画素数を累算して濃度ヒストグラムを作成する手段と、濃度ヒストグラムの情報を用いてこのヒストグラムの形状から処理対象画像の種別を判定する判定手段とを具備している。

【0010】

【作用】この装置において、前記判定手段は、(1)濃度ヒストグラム情報の低濃度部と高濃度部の頻度の和の大小か、(2)濃度ヒストグラム情報のピークの数か、(3)濃度ヒストグラム情報における最大ピーク頻度に対して所定の割合以上の頻度を持つ濃度数か、(4)濃度ヒストグラム情報の中間調部の頻度の大小か、(5)濃度ヒストグラム情報のピーク部の分布の広がり方をヒストグラム形状の特徴として捕えて、処理対象画像の種別を判定する。

【0011】

【実施例】図1は、この発明の一実施例に係る画像処理装置の構成を示す。スキャナ等で文字又は写真の原稿を取り込んで得た入力画像信号E_iは、多値化手段10に入力される。信号E_iは、例えば8ビット/256階調のグレースケールを持つモノクロ画像信号であるか、24ビット/1600万色のカラー画像信号(3原色各々は8ビット処理される)である。信号E_iのグレースケールは、もとの原稿画像の濃度に対応している。

【0012】入力画像信号E_iはヒストグラム作成手段20において複数種のしきい値と比較され、多値化信号D10に変換される。ヒストグラム作成手段20はこの多値化信号D10から原稿画像の濃度ヒストグラムを作成する。

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*【0013】作成される濃度ヒストグラムの数は多値化手段10による多値化数に応じて決まる。例えば多値化手段10による多値化数がn個の場合は、ヒストグラムの数もn個になる。

【0014】作成された濃度ヒストグラムの各度数(頻度)が作り出す形(パターン)は、文字原稿の場合と写真原稿の場合とで異なった傾向を示す。原稿種別判定手段30は、この傾向の違いに基づいて後述する方法により原稿の種別を判定し原稿種別判定信号E_oを出力するもので、例えばマイクロコンピュータ(又はCPU)で構成できる。判定信号E_oは、例えば文字原稿ならロジック"0"レベルとなり、写真原稿ならロジック"1"レベルとなる。

【0015】なお、この判定アルゴリズムは簡単なもので、判定信号E_oを得る構成は、CPUによるソフトウェアのみならずハードウェアロジックでも実現できる。すなわち、原稿種別判定手段30はマイクロコンピュータやCPUに限定はされない。図2は、図1に示される多値化手段10およびヒストグラム作成手段20の具体例を示す。

【0016】多値化数をnとすると、多値化手段10は、n個のしきい値Th₁~Th_nを格納したn個のメモリ101と、入力画像信号E_iをn個のしきい値Th₁~Th_n各々とを比較するn個の比較器102と、比較器102の比較結果C(g)をコード化するエンコーダ103で構成される。ここで、しきい値Th₁~Th_nは、Th₁<Th₂<Th₃...<Th_nの大きさを持つものとする。

【0017】入力画像信号(原稿濃度)E_iの信号レベルをfとし、信号レベルfとしきい値Th₁~Th_n各々との比較結果をC(g)とすると、C(g=0)~C(g=n-1)は次のようになる：

$$\begin{aligned} C(0 \sim n-1) &= "0" & : f < Th_1 \\ C(0) &= "1" & ; C(1 \sim n-1) = "0" : Th_2 > f \geq Th_1 \\ C(0, 1) &= "1" & ; C(2 \sim n-1) = "0" : Th_3 > f \geq Th_2 \\ C(0 \sim 2) &= "1" & ; C(3 \sim n-1) = "0" : Th_4 > f \geq Th_3 \\ & \dots \dots \dots \\ C(0 \sim n-2) &= "1" & ; C(n-1) = "0" : Th_n > f \geq Th_{n-1} \\ & 1 \\ C(0 \sim n-1) &= "1" & : f \geq Th_n \end{aligned}$$

【0018】エンコーダ103は上記C(g=0)~C(g=n-1)をコード化して、以下のようなn段階の値(g=0~g=n-1)を持つ多値化信号D10を出力する：

$$\begin{aligned} g=0 & : f < Th_1 \\ g=1 & : Th_2 > f \geq Th_1 \\ g=2 & : Th_3 > f \geq Th_2 \\ g=3 & : Th_4 > f \geq Th_3 \\ & \dots \dots \dots \end{aligned}$$

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$$\begin{aligned} g=n-2 & : Th_{n-1} > f \geq Th_{n-2} \\ g=n-1 & : f \geq Th_{n-1} \end{aligned}$$

ここで、値gの大きさはg=0が最小値であり、g=n-1が最大値である。

【0019】すなわち、入力画像信号(原稿濃度)の信号レベルfがf<Th₁であれば多値化信号D10はg=0の最小値をとり、f≥Th_{n-1}であれば多値化信号D10はg=n-1の最大値をとり、Th₃>f≥Th₂であれば多値化信号D10はg=2の中間値をと

る。このエンコーダ103は、例えばプログラマブルロジックデバイスで構成することができる。

【0020】上記n段階の値を持つ多値化信号D10はヒストグラム作成手段20のデコーダ201に入力される。デコーダ201はn個の出力D(0)～D(n-1)をもち、入力された信号D10の値に応じた出力だけロジックレベル”1”にする。これらn個の出力D(0)～D(n-1)は、n個の加算器202それぞれの一方入力に与えられる。これら加算器202の他方入力には、n個のレジスタ203の出力がそれぞれ与えられ、加算器202の加算結果がそれぞれ対応するレジスタ203に戻される。これらのレジスタ203の内容は全て、信号Eiが与えられる毎にクリアされるようになっている。このデコーダ201も、プログラマブルロジックデバイスで構成することができる。

【0021】なお、入力画像信号EiがA3サイズの写真稿を400dpiの解像度で読み取ったものであるときは、n個のレジスタ203それぞれには25ビットの容量が必要となる。

【0022】加算器202およびレジスタ203は、多値化信号D10のn種のレベルそれぞれに用意された累算回路(アップカウンタ)を構成している。例えば信号D10がg=2の中間値をとる場合はデコーダ出力D(2)だけが”1”レベルとなり、それ以外の出力D(0～1)、D(3～n-1)は全て”0”レベルとなる。この場合、加算器(2)によりレジスタ(2)の内容(頻度数)に”1”が加算され、レジスタ(2)の出力H(2)が1つ増える(アップカウント)。同様に、デコーダ出力D(0)が”1”のときはレジスタ出力H(0)が1つアップカウントされ、デコーダ出力D(1)が”1”のときはレジスタ出力H(1)が1つアップカウントされ、デコーダ出力D(n-1)が”1”のときはレジスタ出力H(n-1)が1つアップカウントされる。

【0023】上記アップカウント(累算処理)は、多値化手段10に順次入力される画素値毎に繰り返され、原稿1頁分の入力が終了するまで続けられる。この入力が終了した後には得られるレジスタ出力H(0)は入力原稿の低濃度部の累積頻度を示し、レジスタ出力H(n-1)は入力原稿の高濃度部の累積頻度を示し、レジスタ出力H(1)～H(n-2)は入力原稿の中間濃度部(中間調領域)の累積頻度を示すようになる。そして、レジスタ出力H(0)～H(n-1)を濃度順に並べたものが、多値化した画像信号の濃度ヒストグラムとなる。

【0024】こうして得られた濃度ヒストグラムをグラフ化してみると、その形状/パターンが文字原稿と写真原稿で異なっている。そこで、以下に述べる方法でこの形状/パターンの違いを検出することにより、入力された画像信号が文字原稿によるものなのか写真原稿による

ものなのかを判定できる。

【0025】以下、n=8で入力画像を多値化する簡単な場合を想定して、原稿種別判定方法の具体例を説明する。(この場合、ヒストグラムは8つの濃度累積頻度H(0)～H(7)で構成される。)

(第1の判定方法)

【0026】図3は、文字および写真画像原稿から得られる代表的な濃度ヒストグラムを示す。以下この図を参照して、低濃度部の頻度と高濃度部の頻度との和の大小関係で文字画像であるか写真画像であるかを判定する方法を説明する。

【0027】文字原稿は背景部とそこに記載された文字部で構成され、一般に背景部が大半を占める。文字原稿では背景部の濃度レベルと文字部の濃度レベルの間の階調を持つ画像は殆どない。いま白地(低濃度)の背景部に黒文字(高濃度)が記載された文字原稿を考えてみると、低濃度部に頻度が集中し、次に高濃度部に頻度が集中する。すると、図3(a)に例示するように、文字原稿の濃度ヒストグラムは、中央部が凹んだ形状になる。

【0028】一方、写真原稿は低濃度部から高濃度部に至る全ての階調(グレースケール)を持つが、一般的に言えば中間階調部分に多くの画像情報が集中する。いま白地(低濃度)の背景部にグレースケールを伴う画像(中間濃度)が加わった写真原稿を考えてみると、原稿に占めるこの中間濃度画像面積の割合が比較的大きいならば、中間濃度部に頻度が集中する。すると、図3

(b)に例示するように、写真原稿の濃度ヒストグラムの形状(パターン)は、中央部が突起したものになる。

【0029】ここで濃度ヒストグラムの最低濃度部(H(0)側)および最高濃度部(H(7)側)に着目すると、最低濃度部の頻度H(0)と最高濃度部の頻度H(7)の和が、文字原稿と写真原稿とで明らかに異なることが分かる。そこで、所定の比較レベルTx1を設定し、以下の比較を行えば、文字原稿と写真原稿を識別判定できるようになる：

$H(0) + H(7) \geq Tx1$; $Eo = "0"$ (文字原稿)

$H(0) + H(7) < Tx1$; $Eo = "1"$ (写真原稿)

(第2の判定方法) 次に、図4を参照して、ヒストグラム中に現われる頻度のピーク(極大値)の数によって文字画像であるか写真画像であるかを判定する方法を説明する。

【0030】文字原稿では背景部と文字部の2箇所に濃度が集中するので、図4(a)に示すように、最低濃度部と最高濃度部の2箇所に累積頻度のピークができる。一方、写真原稿では主体がグレースケールを持つ画像であるため、図4(b)に示すように、中間調領域の1箇所に濃度のピークができる確率が高い。濃度ヒストグラムにおける上記ピークは、 $H(i) \geq H(i-1)$ かつ

$H(i) \geq H(i+1)$ なる条件を満たすヒストグラム $H(i)$ を検索すれば、発見できる。なお、パラメータ i は $0 \leq i < n$ (この例では $i = 0 \sim 7$) なる条件を満たすものとする。

【0031】図4(a)の例では $H(i=0)$ と $H(i=7)$ の2箇所ピークが発見され、図4(b)の例では $H(i=4)$ の1箇所ピークが発見される。そこで、発見されたピークの数(i の数)を P とした場合、以下の関係から、文字原稿と写真原稿を識別判定できるようにする：

$P=2$; $E_o="0"$ (文字原稿)

$P \neq 2$; $E_o="1"$ (写真原稿)

(第3の判定方法)

【0032】次に、図5を参照して、ヒストグラム中に現われる最大頻度数を100%としたときに $T\%$ ($0 < T < 100$) 以上の頻度をもつ濃度の数によって文字画像であるか写真画像であるかを判定する方法を説明する。

【0033】一般に、写真原稿では中間調部分に相対的に大きな頻度が広く分布し、また、文字原稿では低濃度と高濃度の両端部に大きな頻度が狭く分布する。文字原稿では通常、文字部よりもその背景部の方が相対的に画像面積が広がるので、頻度の値(ピーク高)は高濃度側よりも低濃度側の方が高くなる確率が高い。すると、低濃度側の頻度以下で高濃度側の頻度以上の所定頻度レベル T を設定し、レベル T 以上の頻度のものに注目してみる。すると、文字原稿では頻度が相対的に少なく、写真原稿では頻度が相対的に大きくなる。図5(a)、

(b)は、例えば $T=50\%$ より頻度の高いものが文字原稿と写真原稿でどのように違うかを例示している。そこで、 $H(\max)$ を最大頻度値とし、 $0 \leq i < n$ なるパラメータ i を考えたときに、

$H(i) \geq H(\max) \times T(\%)$

を満たす i の個数を M とし、所定の比較数 $T \times 2$ を設定すれば、以下の関係から、文字原稿と写真原稿を識別判定できるようにする：

$M < T \times 2$; $E_o="0"$ (文字原稿)

$M \geq T \times 2$; $E_o="1"$ (写真原稿)

(第4の判定方法) 次に、図6を参照して、ヒストグラムの中間調部における頻度の大小関係で文字画像であるか写真画像であるかを判定する方法を説明する。

【0034】文字原稿では濃度の低い背景部が大半を占めそれに高濃度の文字部が入っているので、低濃度部と高濃度部に高頻度が集中する。一方、写真原稿ではグレースケールを持つ画像が大半を占めるために中間濃度部に比較的頻度の高いものが集まる。したがって、中間調部分に着目すると、図6(a)に示すように文字原稿では頻度が少なく、写真原稿では頻度が多くなる。

【0035】そこで、中間調部分の頻度をいくつかを選び(たとえば $H(3)$ と $H(4)$)、所定の比較数 $T \times$

3を設定すれば、以下の関係から、文字原稿と写真原稿を識別判定できるようになる ($n=8$) :

$H(n/2-1) + H(n/2) < T \times 3$; $E_o="0"$ (文字原稿)

$H(n/2-1) + H(n/2) \geq T \times 3$; $E_o="1"$ (写真原稿)

(第5の判定方法) 次に、図7を参照して、ヒストグラム中に現われるピークの分布(広がり)によって文字画像であるか写真画像であるかを判定する方法を説明する。

【0036】既に述べてきたように、文字原稿では濃度の低い背景部が大半を占めそれに高濃度の文字部が入っているので、低濃度部と高濃度部の狭い範囲に高頻度が集中する。一方、写真原稿ではグレースケールを持つ画像が大半を占めるために中間濃度部に比較的頻度の高いものが広く分布する。

【0037】そこで、ヒストグラムのピーク頻度値の例えば30%の所に所定のレベル L を設定し、ピーク頻度値の位置(図7(a)では $H(0)$; 図7(b)では $H(4)$) から、レベル L 以下のうちでピーク位置に最も近い頻度値の位置(図7(a)では $H(2)$; 図7

(b)では $H(1)$) までの間隔 W を検出し、所定の比較数 $T \times 4$ を設定すれば、以下の関係から、文字原稿と写真原稿を識別判定できるようになる：

$W < T \times 4$; $E_o="0"$ (文字原稿)

$W \geq T \times 4$; $E_o="1"$ (写真原稿)

【0038】なお、レベル L を越える頻度値を持つ一群のうち最も大きなもの(図7(a)では $H(0)$ 、 $H(1)$; 図7(b)では $H(2) \sim H(6)$) の幅 W' を検出し、所定の比較数 $T \times 4'$ を設定すれば、以下の関係を用いても、文字原稿と写真原稿との識別判定が可能になる：

$W' < T \times 4'$; $E_o="0"$ (文字原稿)

$W' \geq T \times 4'$; $E_o="1"$ (写真原稿)

(第6の判定方法)

【0039】次に、図8を参照して、ヒストグラム中間調部における頻度を作る面積とその補数を作る面積との比の大小関係で文字画像であるか写真画像であるかを判定する方法を説明する。

【0040】いま、黒べた原稿あるいは白べた原稿から得られる最大頻度を Z とし、頻度 $H(0) \sim H(7)$ の幅と最大頻度 Z とで形成される面 S 内に図6と同様なヒストグラムを書き込んでみる。このヒストグラムのうち、中間調部分に着眼すると、図8(a)、(b)に示すように、ヒストグラムの頻度 $H(3)$ 、 $H(4)$ が作る面積 S_1 と、着眼部の残り面積 S_2 (Z 平面の着眼部面積に関する S_1 の補数) との比 S_1/S_2 が文字原稿と写真原稿とで異なってくる。そこで、所定の比較数 $T \times 5$ を設定すれば、以下の関係から、文字原稿と写真原稿を識別判定できるようになる：

$S1/S2 < T \times 5$; $E_o = "0"$ (文字原稿)

$S1/S2 \geq T \times 5$; $E_o = "1"$ (写真原稿)

【0041】なお、この発明は上記複数の方法のいずれか1つで原稿種別の判定が可能であるが、毛筆文字原稿のように中間調情報が比較的多い文字原稿と、図形写真のようにコントラストが強く中間調情報が少ない写真原稿とを扱う場合では判別が困難になることもあり得る。この場合は、上記方法のうち例えば3以上を併用しその結果から原稿種別の判定を行なってもよい。例えば、ある写真原稿について、第2の方法が文字原稿と判定しても、第1、第3の方法が写真原稿と判定すれば、それを写真原稿と判定できる。

【0042】

【発明の効果】この発明によれば、ヒストグラム情報から簡単に対象画像の種別を判定できる。また、この発明では、従来のようにブロック単位あるいは画素単位で画像の種別判定をするのではなく画像単位で種別判定を行なうので、画像全体に単一の処理を施すことになるから、均一性の良い画像処理が可能となる。

【図面の簡単な説明】

【図1】図1は、この発明の一実施例に係る画像処理装置の構成を示すブロック図。

【図2】図2は、図1に示される多値化手段とヒストグラム作成手段の具体例を示すブロック図。

【図3】図3は、文字および写真画像原稿から得られる濃度ヒストグラムを例示するもので、低濃度部の頻度と高濃度部の頻度との和の大小関係で文字画像であるか写真画像であるかを判定する方法を説明する図。

【図4】図4は、文字および写真画像原稿から得られる濃度ヒストグラムを例示するもので、ヒストグラム中に*

*現われるピーク（極大値）の数によって文字画像であるか写真画像であるかを判定する方法を説明する図。

【図5】図5は、文字および写真画像原稿から得られる濃度ヒストグラムを例示するもので、ヒストグラム中に現われる最大頻度数を100%としたときにT% ($0 < T < 100$)以上の頻度をもつ濃度の数によって文字画像であるか写真画像であるかを判定する方法を説明する図。

【図6】図6は、文字および写真画像原稿から得られる濃度ヒストグラムを例示するもので、ヒストグラムの中間調部における頻度の大小関係で文字画像であるか写真画像であるかを判定する方法を説明する図。

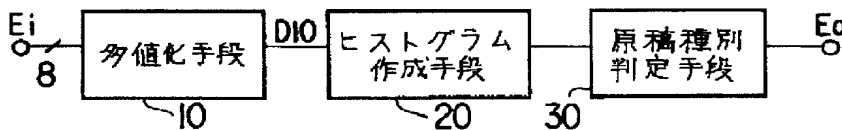
【図7】図7は、文字および写真画像原稿から得られる濃度ヒストグラムを例示するもので、ヒストグラム中に現われるピークの分布（広がり）によって文字画像であるか写真画像であるかを判定する方法を説明する図。

【図8】図8は、文字および写真画像原稿から得られる濃度ヒストグラムを例示するもので、ヒストグラム中間調部における頻度を作る面積とその補数を作る面積との比の大小関係で文字画像であるか写真画像であるかを判定する方法を説明する図。

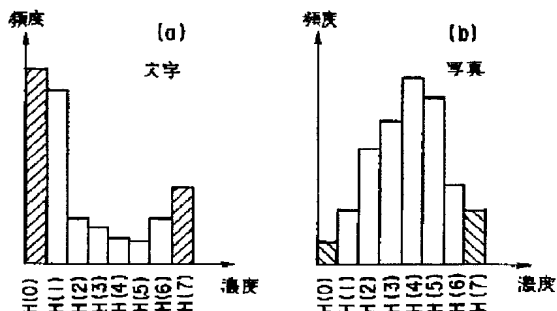
【符号の説明】

10・・・多値化手段、20・・・ヒストグラム作成手段、30・・・原稿種別判定手段、101・・・しきい値メモリ、102・・・比較器、103・・・エンコーダ、201・・・デコーダ、202・・・加算器、203・・・レジスタ、 E_i 、 $E_i(f)$ ・・・入力画像信号、 $C(g)$ ・・・比較結果、 E_o ・・・原稿種別判定信号。

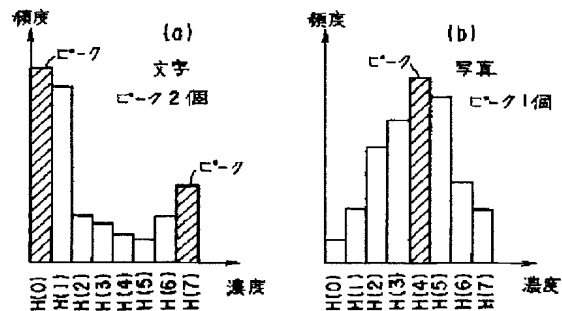
【図1】



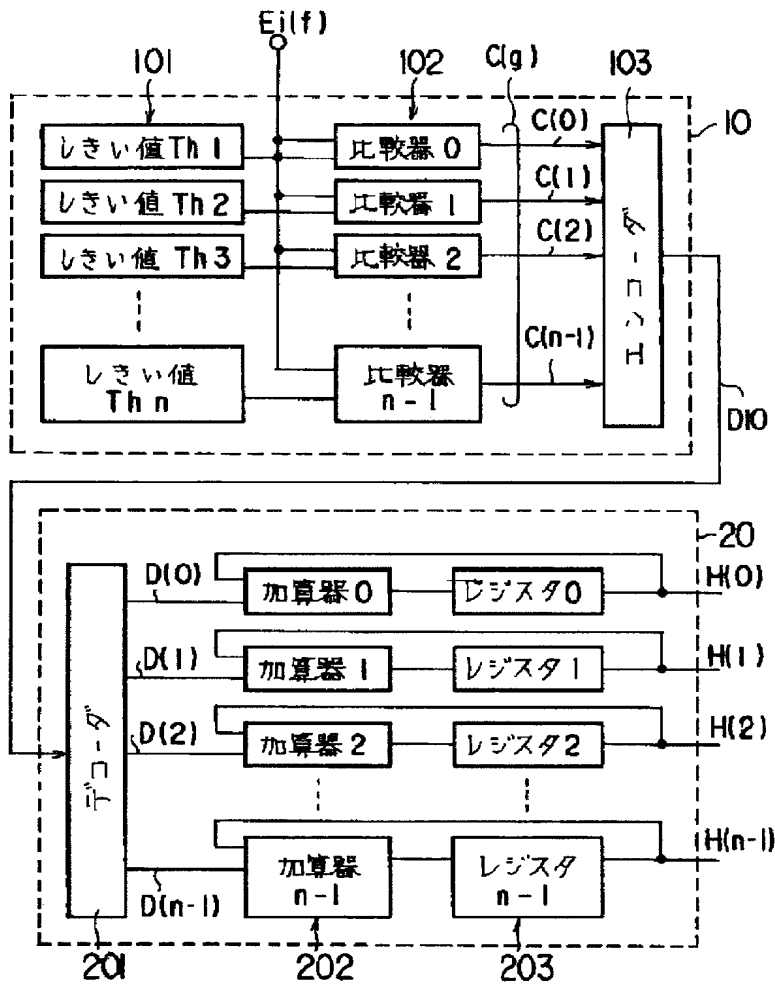
【図3】



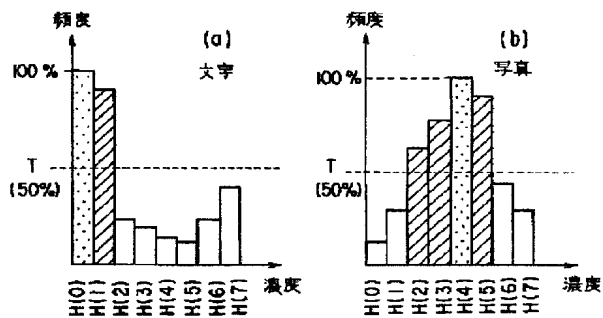
【図4】



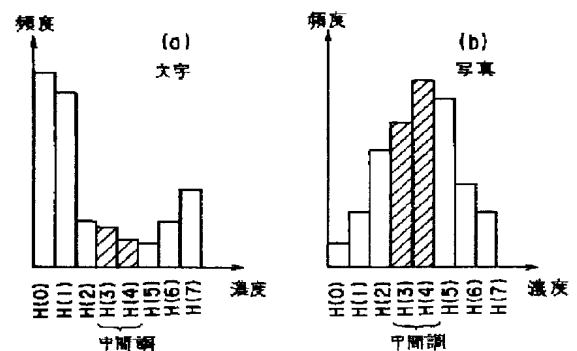
【図2】



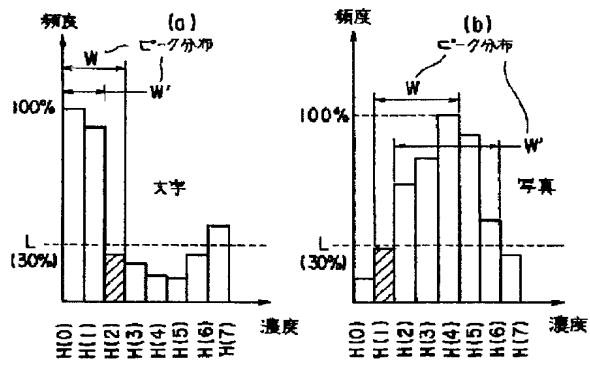
【図5】



【図6】



【図7】



【図8】

